Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended): A method of determining data flow for a channel having a plurality of subchannels in a multi-carrier system, comprising:

determining data flow for the channel ~~in terms of~~based on an input intensity λ_{in}, ~~and~~ a probability of having a frame having no or a correctable number of errors p, and a maximum number of transmissions k of the frame; and

adjusting channel performance in accordance with the data flow.

Claim 2 (currently amended): The method of claim 1 wherein said data flow is determined in accordance with the following relationships:

$$\lambda_{nac} = \lambda_{in} \frac{\left[1-(1-p)^k\right](1-p)}{p}$$

$$\lambda_{ti} = \lambda_{in} \frac{1-(1-p)^k}{p},$$

$$\lambda_{pout} = \lambda_{in}\left[1-(1-p)^k\right],$$

$$\lambda_{rt} = \lambda_{in} \frac{(1-p)\left[1-(1-p)^{k-1}\right]}{p}, \text{ and}$$

$$\lambda_{nout} = \lambda_{in}(1-p)^k \quad ,$$

λ_{nac} represents a negative acknowledgement intensity, ~~k represents a maximum number of transmissions,~~ λ_{ti} represents a transmitter intensity, λ_{pout} represents an intensity of good and correctable frames; λ_{rt} represents a retransmission intensity; λ_{nout} represents an intensity of erroneous frames that are non-correctable after a maximum number of transmissions; and

adjusting channel performance in accordance with the data flow.

Claim 3 (original): The method of claim 2 wherein the data flow is determined by applying said relationships to data flow in a downstream direction, and applying said relationships to data flow in an upstream direction.

Claim 4 (currently amended): A method of determining data flow for a channel having a plurality of subchannels in a multi-carrier system, comprising:

determining an upstream data flow based on a maximum number transmissions of each frame;

determining a downstream data flow based on the maximum number of transmissions of each frame; and

superimposing the upstream data flow and the downstream data flow to determine a channel data flow.

Claim 5 (original): The method of claim 4 wherein the channel uses forward error correction.

Claim 6 (canceled)

Claim 7 (canceled)

Claim 8 (canceled)

Claim 9 (currently amended): A method of determining throughput in a multicarrier transmission system having a channel, comprising:

generating a representation of the throughput of the channel in a first direction with respect to the throughput of the channel in a second direction, ~~The method of claim 8~~ wherein the representation is generated in accordance with the following relationships:

$$\frac{M_d}{K_d}\left[\frac{1}{m_d}+\frac{1-p_d}{p_d}\right]\left[1-(1-p_d)^{k_d}\right]\Lambda_d+\frac{N_u}{K_u}\frac{1-(1-p_u)^{k_u}}{p_u}\Lambda_u \le V_u, \text{ and}$$

$$\frac{N_d}{K_d}\frac{1-(1-p_d)^{k_d}}{p_d}\Lambda_d+\frac{M_u}{K_u}\left[\frac{1}{m_u}+\frac{1-p_u}{p_u}\right]\left[1-(1-p_u)^{k_u}\right]\Lambda_u \le V_d,$$

wherein M_d represents a length of an acknowledgment frame in a downstream direction, K_d represents the length of an information field in the downstream direction, m_d represents a number of information frames between positive acknowledgment frames in the downstream direction, p_d represents a probability of an information frame being accepted in the downstream direction, k_d represents a maximum number of transmissions in the downstream direction, Λ_d represents a number of information bits per unit time in the downstream direction, N_d represents a total frame length in the downstream direction, M_u represents a length of an acknowledgment frame in an upstream direction, N_u represents a total frame length in the upstream direction, K_u represents the length of an information field in the upstream direction, m_u represents a number of information frames between positive acknowledgment frames in the upstream direction, p_u represents a probability of an information frame being accepted in the upstream direction, k_u represents a maximum number of transmissions in the upstream direction, Λ_u represents a number of information bits per unit time in the upstream direction, V_u represents a data rate in the upstream direction, and V_d represents a data rate in the downstream direction; and

determining the throughput of the channel in a first direction with respect to the throughput of the channel in a second direction using the representation.

Claim 10 (original): A method of determining throughput in a multicarrier transmission system, comprising:

determining the throughput of a channel in an upstream and downstream direction in accordance with the following relationships:

$$H_u = \max \Lambda_u = \min\left\{ \begin{array}{l} V_u \Big/ \left[\dfrac{N_d}{K_d} \dfrac{1-(1-p_d)^{k_d}}{p_d} + \dfrac{M_u}{K_u} \dfrac{V_u}{V_d} \left(\dfrac{1}{m_u} + \dfrac{1-p_u}{p_u} \right) \left(1-(1-p_u)^{k_u}\right) \right], \\ V_u \Big/ \left[\dfrac{M_d}{K_d} \dfrac{V_d}{V_u} \left(\dfrac{1}{m_d} + \dfrac{1-p_d}{p_d} \right) \left(1-(1-p_d)^{k_d}\right) + \dfrac{N_u}{K_u} \dfrac{1-(1-p_u)^{k_u}}{p_u} \right] \end{array} \right\}, \text{ and}$$

$$H_d = \max \Lambda_d = \min\left\{ \begin{array}{l} V_d \Big/ \left[\dfrac{N_d}{K_d} \dfrac{1-(1-p_d)^{k_d}}{p_d} + \dfrac{M_u}{K_u} \dfrac{V_u}{V_d} \left(\dfrac{1}{m_u} + \dfrac{1-p_u}{p_u} \right) \left(1-(1-p_u)^{k_u}\right) \right], \\ V_d \Big/ \left[\dfrac{M_d}{K_d} \dfrac{V_d}{V_u} \left(\dfrac{1}{m_d} + \dfrac{1-p_d}{p_d} \right) \left(1-(1-p_d)^{k_d}\right) + \dfrac{N_u}{K_u} \dfrac{1-(1-p_u)^{k_u}}{p_u} \right] \end{array} \right\},$$

wherein M_d represents a length of an acknowledgment frame in a downstream direction, K_d represents the length of an information field in the downstream direction, m_d represents a number of information frames between positive acknowledgment frames in the downstream direction, p_d represents a probability of an information frame being accepted in the downstream direction, k_d represents a maximum number of transmissions in the downstream direction, Λ_d represents a number of information bits per unit time in the downstream direction, N_d represents a total frame length in the downstream direction, M_u represents a length of an acknowledgment frame in an upstream direction, N_u represents a total frame length in the upstream direction, K_u represents the length of an information field in the upstream direction, m_u represents a number of information frames between positive acknowledgment frames in the upstream direction, p_u represents a probability of an information frame being accepted in the upstream direction, k_u

represents a maximum number of transmissions in the upstream direction, Λ_u represents a number of information bits per unit time in the upstream direction, V_u represents a data rate in the upstream direction, and V_d represents a data rate in the downstream direction.

Claim 11 (currently amended): A method of increasing a bit load of a multicarrier system comprising a channel having a plurality of subchannels, comprising:

determining a bit load for at least one subchannel based on a target symbol error rate ε_s, a maximum number of symbol errors that can be corrected t, a number of symbols in an information field K of a frame, and a maximum number of transmissions k of the frame, and a number of bits per subchannel; and

selecting the maximum number of symbol errors t, the number of symbols in the information field K of the frame and the maximum number of transmissions k of the frame, such that a coding gain is increased.

Claim 12 (currently amended): The method of claim 11 wherein the coding gain is a function of an average number of transmissions for a frame.

Claim 13 (original): The method of claim 11 wherein the bit load is determined in accordance with the following relationships:

$$1-\left(1-W(t,K,k)\varepsilon_S^{\frac{1}{(t+1)k}}\right)^{1/\alpha}$$
$$=\omega(b_i)\left(1-2^{-b_i/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_i/10}/\left(2^{b_i+1}-2\right)}\right)\left[2-\left(1-2^{-b_i/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_i/10}/\left(2^{b_i+1}-2\right)}\right)\right]$$

wherein b_i represents a number of bits per subchannel, γ_i represents a signal-to-noise ratio at the i-th subchannel, $\omega(b_i)$ represents an average fraction of erroneous bits in a b_i-sized erroneous quadrature-amplitude-modulation symbol, ε_S represents a target symbol error rate, β represents an effect of a descrambler, and α represent a number of bits per code symbol; and

$$W(t,K,k)=\left[\binom{K+C+R-1}{t}\right]^{-\frac{1}{(t+1)k}}\left[\binom{K+C+R}{t+1}\right]^{-\frac{k-1}{(t+1)k}}$$

C+R represents a number of redundant symbols in an error correction field, and the net coding gain $G_n(t,K,k)$ is determined in accordance with the following relationship:

$$G_n(t,K,k)\equiv\frac{K}{K+C+R}\frac{B_{DMT}(t,K,k)}{\nu}-\frac{K}{K+C}B_{DMT}(0,K,1)$$

ν represents an average number of transmissions, and $B_{DMT}(t, K, k)$ represents a number of bits in a discrete multitone symbol based on the values of t, K and k.

Claim 14 (original): The method of claim 13 wherein $\omega(b_i)$ is approximated in accordance with the following relationship:

$$\omega(b_i)=\frac{4}{3+2b_i}\quad.$$

Claim 15 (original): The method of claim 13 wherein ε_S is determined in accordance with the following relationship:

$$\varepsilon_S=1-\left(1-\frac{\varepsilon}{\beta}\right)^{\alpha},$$

and ε represents a target bit error rate, α represents a length of a code symbol, and β represents the effect of a descrambler.

Claim 16 (original): The method of claim 13 wherein $\omega(b_i)$ is determined in accordance with the following relationship:

$$\omega(b) = \frac{1}{b \cdot 2^b} \sum_{i=1}^{2^b} \sum_{j \neq i}^{\chi_i} \frac{d_H(a_i, a_j)}{\chi_i},$$

b represents a number of bit positions of a quadrature-amplitude-modulation symbol, a_i represents a label for the i^{th} point of a constellation associated with a subchannel, a_j represents a label for the j^{th} point of a constellation associated with a subchannel, and χ_i represents a coordination number of the a_i^{th} point, $d_H(a_i, a_j)$ represents a Hamming distance between respective binary vectors associated with points a_i and a_j.

Claim 17 (original): The method of claim 11 further comprising:

determining a total increase in the number of bits to be sent in a DMT symbol ($G_l(t,K,k)$) in accordance with the following relationship:

$$G_d(t,K,k) \equiv B_{DMT}(t,K,k) - B_{DMT}(0,K,1).$$

Claim 18 (currently amended): A method of determining an uncoded bit error rate p_b based on a target symbol error rate ε_s and a maximum number of transmissions k <u>of a frame</u>, comprising:

determining the uncoded bit error rate p_b based on a weighted series expansion of the target bit error rate ε_s, comprising weights W that are a function of a maximum number of symbol errors that can be corrected t and a number of symbols in an information field K <u>of the frame</u>; and

selecting the maximum number of symbol errors t, the number of symbols in the information field K <u>of the frame</u> and the maximum number of transmissions k <u>of the frame</u>, such that the uncoded bit error rate p_b that produces a symbol error rate that is less than or equal to the target symbol error rate ε_s is largest.

Claim 19 (original): The method of claim 18 wherein said weighted series expansion to determine said uncoded bit error rate p_b comprises the following relationship:

$$p_b = 1-\left(1-W\left(t,K,k\right)\varepsilon_S^{\frac{1}{(t+1)k}}\right)^{1/\alpha}$$

wherein

$$W(t,K,k)=\left[\binom{K+C+R-1}{t}\right]^{-\frac{1}{(t+1)k}}\left[\binom{K+C+R}{t+1}\right]^{-\frac{k-1}{(t+1)k}},$$

C+R represents a number of redundant symbols in an error correction field.

Claim 20 (currently amended): A method of selecting transmission parameters a multicarrier system having a channel comprising a plurality of subchannels, comprising:

selecting a number (s) of discrete multi-tone symbols in a forward-error-correction frame, a number (z) of forward-error-correction control symbols in a discrete multitone symbol, and a maximum number of transmissions (k) of a frame, based on a signal-to-noise ratio and a number of subchannels associated with the signal-to-noise ratio; and

transmitting information in accordance with the selected number (s) of discrete multi-tone symbols, the number (z) of forward-error-correction control symbols in the discrete multitone symbol and the maximum number of transmissions (k) of the frame.

Claim 21 (original): The method of claim 20 wherein said selecting comprises selecting an adjustment value per subchannel based on the signal-to-noise ratio and the number of subchannels associated with the signal-to-noise ratio; and

adjusting a number of bits per subchannel for at least one subchannel in accordance with the adjustment value.

Claim 22 (original): The method of claim 20 wherein the signal-to-noise ratio is an average signal-to-noise ratio of the associated number of subchannels.

Claim 23 (currently amended): The method of claim 20 further comprising:

storing, in a table, the number (s) of discrete multi-tone symbols in the forward-error-correction frame, the number (z) of forward-error-correction control symbols in the discrete multitone symbol associated with the signal-to-noise ratio, the maximum number of transmissions (k) of a frame, and the number of subchannels associated with the signal-to-noise ratio, for different values of s, z, signal-to-noise ratios and numbers of subchannels.

Claim 24 (original): The method of claim 23 wherein for each value of signal-to-noise ratio and number of bits per subchannel of the table, the associated values of s, z and k are also associated with an adjustment value that provides a maximal net coding gain g_n, such that the associated values of s, z and k is selected from a subset of associated s, z and k values.

Claim 25 (original): A method of determining an optimum bit load b per subchannel in a multicarrier system with forward error correction, comprising:

computing one or more values of a maximum number of symbol errors that can be corrected t, a number of symbols in the information field K and a maximum number of transmissions k to determine the optimum bit load per subchannel in accordance with the following relationship:

$$b = [\gamma + \Phi(\gamma, t, K, k, \varepsilon)]/10\log 2$$

wherein

$$\Phi(\gamma,t,K,k,\varepsilon)=10\log\left\{10^{-\gamma/10}+\frac{3\log e}{2\log\left[\frac{\alpha\langle\omega(b)\rangle\sqrt{8/\pi}}{W(t,K,k)(\alpha\,\varepsilon/\beta)^{\frac{1}{(t+1)k}}}\right]-\log\log\left[\frac{\alpha\langle\omega(b)\rangle\sqrt{8/\pi}}{W(t,K,k)(\alpha\,\varepsilon/\beta)^{\frac{1}{(t+1)k}}}\right]+\log\left(\frac{\log e}{2}\right)}\right\}$$

$$W(t,K,k)=\left[\binom{K+C+R-1}{t}\right]^{-\frac{1}{(t+1)k}}\left[\binom{K+C+R}{t+1}\right]^{-\frac{k-1}{(t+1)k}},$$

$$\langle\omega(b)\rangle=\frac{1}{b_{max}}\int_{1}^{b_{max}}\omega(b)(1-2^{-b/2})db$$

α represents a number of bits per symbol, γ represents a signal-to-noise ratio, ε represents a target symbol error rate, k represents a maximum number of transmissions, C+R represents a number of redundant symbols in an error correction field, b represents a number of bit positions of a quadrature-amplitude-modulation symbol, $\omega(b)$ represents an average fraction of erroneous bits in an erroneous b-sized quadrature-amplitude-modulation symbol, and b_{max} is a maximum number of bit positions of the quadrature-amplitude-modulation symbol per subchannel; and

selecting a bit load per subchannel in accordance with the maximum number of symbol errors that can be corrected t, a number of symbols in the information field K and the maximum number of transmissions k.

Claim 26 (original): A method for transmitting data in a multi-carrier system between a downstream station and an upstream station, coupled by a channel having a plurality of subchannels, comprising:

transmitting an information frame from the upstream station;

receiving the information frame at the downstream station;

determining whether the information frame is non-correctable;

transmitting a negative acknowledgement when the information frame is non-correctable; and

transmitting the information frame if the information frame has not be transmitted a predetermined number of times from the upstream station.

Claim 27 (original): The method of claim 26 wherein the predetermined number of times is determined in accordance with a measured signal-to-noise ratio value representing at least a subset of the subchannels of the channel, and forward error correction parameters.

Claim 28 (original): The method of claim 26 wherein the multi-carrier system is a discrete multi-tone system.

Claim 29 (original): The method of claim 26 wherein the discrete multi-tone system comprises the G-lite standard.

Claim 30 (original): The method of claim 26 wherein the discrete multi-tone system comprises the G.dmt standard.

Claim 31 (original): The method of claim 26 wherein the forward error correction parameters are Reed-Solomon forward error correction parameters.

Claim 32 (canceled)

Claim 33 (currently amended): ~~The apparatus of claim 32~~ An apparatus for determining throughput in a multicarrier transmission system having a channel, comprising:

means for generating a representation of the throughput of the channel in a first direction with respect to the throughput of the channel in a second direction wherein the representation is generated in accordance with the following relationships:

$$\frac{M_d}{K_d}\left[\frac{1}{m_d}+\frac{1-p_d}{p_d}\right]\left[1-(1-p_d)^{k_d}\right]\Lambda_d+\frac{N_u}{K_u}\frac{1-(1-p_u)^{k_u}}{p_u}\Lambda_u \le V_u, \text{ and}$$

$$\frac{N_d}{K_d}\frac{1-(1-p_d)^{k_d}}{p_d}\Lambda_d+\frac{M_u}{K_u}\left[\frac{1}{m_u}+\frac{1-p_u}{p_u}\right]\left[1-(1-p_u)^{k_u}\right]\Lambda_u \le V_d,$$

wherein M_d represents a length of an acknowledgment frame in a downstream direction, K_d represents the length of an information field in the downstream direction, m_d represents a number of information frames between positive acknowledgment frames in the downstream direction, p_d represents a probability of an information frame being accepted in the downstream direction, k_d represents a maximum number of transmissions in the downstream direction, Λ_d represents a number of information bits per unit time in the downstream direction, N_d represents a total frame length in the downstream direction, M_u represents a length of an acknowledgment frame in an upstream direction, N_u represents a total frame length in the upstream direction, K_u represents the length of an information field in the upstream direction, m_u represents a number of information frames between positive acknowledgment frames in the upstream direction, p_u represents a probability of an information frame being accepted in the upstream direction, k_u represents a maximum number of transmissions in the upstream direction, Λ_u represents a number of information bits per unit time in the upstream direction, V_u represents a data rate in the upstream direction, and V_d represents a data rate in the downstream direction; and

means for determining the throughput of the channel in a first direction with respect to the throughput of the channel in a second direction using the representation.

Claim 34 (original): An apparatus for determining throughput in a multicarrier transmission system, comprising:

means for determining the throughput of a channel in an upstream and downstream direction in accordance with the following relationships:

$$H_u = \max \Lambda_u = \min\left\{ \begin{array}{l} V_u \Big/ \left[\dfrac{N_d}{K_d} \dfrac{1-(1-p_d)^{k_d}}{p_d} + \dfrac{M_u}{K_u} \dfrac{V_u}{V_d} \left(\dfrac{1}{m_u} + \dfrac{1-p_u}{p_u} \right) \left(1-(1-p_u)^{k_u}\right) \right], \\ V_u \Big/ \left[\dfrac{M_d}{K_d} \dfrac{V_d}{V_u} \left(\dfrac{1}{m_d} + \dfrac{1-p_d}{p_d} \right) \left(1-(1-p_d)^{k_d}\right) + \dfrac{N_u}{K_u} \dfrac{1-(1-p_u)^{k_u}}{p_u} \right] \end{array} \right\}, \text{ and}$$

$$H_d = \max \Lambda_d = \min\left\{ \begin{array}{l} V_d \Big/ \left[\dfrac{N_d}{K_d} \dfrac{1-(1-p_d)^{k_d}}{p_d} + \dfrac{M_u}{K_u} \dfrac{V_u}{V_d} \left(\dfrac{1}{m_u} + \dfrac{1-p_u}{p_u} \right) \left(1-(1-p_u)^{k_u}\right) \right], \\ V_d \Big/ \left[\dfrac{M_d}{K_d} \dfrac{V_d}{V_u} \left(\dfrac{1}{m_d} + \dfrac{1-p_d}{p_d} \right) \left(1-(1-p_d)^{k_d}\right) + \dfrac{N_u}{K_u} \dfrac{1-(1-p_u)^{k_u}}{p_u} \right] \end{array} \right\},$$

wherein M_d represents a length of an acknowledgment frame in a downstream direction, K_d represents the length of an information field in the downstream direction, m_d represents a number of information frames between positive acknowledgment frames in the downstream direction, p_d represents a probability of an information frame being accepted in the downstream direction, k_d represents a maximum number of transmissions in the downstream direction, Λ_d represents a number of information bits per unit time in the downstream direction, N_d represents a total frame length in the downstream direction, M_u represents a length of an acknowledgment frame in an upstream direction, N_u represents a total frame length in the upstream direction, K_u represents the length of an information field in the upstream direction, m_u represents a number of information frames between positive acknowledgment frames in the upstream direction, p_u represents a probability of an information frame being accepted in the upstream direction, k_u represents a maximum number of transmissions in the upstream direction, Λ_u represents a number of information bits per unit time in the upstream direction, V_u represents a data rate in the upstream direction, and V_d represents a data rate in the downstream direction.

Claim 35 (currently amended): An apparatus for increasing a bit load of a multicarrier system comprising a channel having a plurality of subchannels, comprising:

means for determining a bit load for at least one subchannel based on a target symbol error rate ε_S, a maximum number of symbol errors that can be corrected t, a number of symbols in an information field K of a frame, and a maximum number of transmissions k of the frame, and a number of bits per subchannel; and

means for selecting the maximum number of symbol errors t, the number of symbols in the information field K of the frame and the maximum number of transmissions k of the frame, such that a coding gain is increased.

Claim 36 (original): The apparatus of claim 35 wherein the coding gain is a function of an average number of transmissions for a frame.

Claim 37 (original): The apparatus of claim 35 wherein the bit load is determined in accordance with the following relationships:

$$1-\left(1-W(t,K,k)\varepsilon_S^{\frac{1}{(t+1)k}}\right)^{1/\alpha} = \omega(b_i)\left(1-2^{-b_i/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_i/10}/\left(2^{b_i+1}-2\right)}\right)\left[2-\left(1-2^{-b_i/2}\right)erfc\left(\sqrt{3\cdot 10^{\gamma_i/10}/\left(2^{b_i+1}-2\right)}\right)\right]$$

wherein b_i represents a number of bits per subchannel, γ_i represents a signal-to-noise ratio at the i-th subchannel, $\omega(b_i)$ represents an average fraction of erroneous bits in a b_i-sized erroneous quadrature-amplitude-modulation symbol, ε_S represents a target symbol error rate, β represents an effect of a descrambler, and α represent a number of bits per code symbol; and

$$W(t,K,k) = \left[\binom{K+C+R-1}{t}\right]^{-\frac{1}{(t+1)k}}\left[\binom{K+C+R}{t+1}\right]^{-\frac{k-1}{(t+1)k}}$$

C+R represents a number of redundant symbols in an error correction field, and the net coding gain $G_n(t,K,k)$ is determined in accordance with the following relationship:

$$G_n(t,K,k) \equiv \frac{K}{K+C+R} \frac{B_{DMT}(t,K,k)}{\nu} - \frac{K}{K+C} B_{DMT}(0,K,1)$$

ν represents an average number of transmissions, and $B_{DMT}(t, K, k)$ represents a number of bits in a discrete multitone symbol based on the values of t, K and k.

Claim 38 (original): The apparatus of claim 37 wherein $\omega(b_i)$ is approximated in accordance with the following relationship:

$$\omega(b_i) = \frac{4}{3+2b_i} \quad .$$

Claim 39 (original): The apparatus of claim 37 wherein ε_s is determined in accordance with the following relationship:

$$\varepsilon_S = 1 - \left(1 - \frac{\varepsilon}{\beta}\right)^{\alpha},$$

and ε represents a target bit error rate, α represents a length of a code symbol, and β represents the effect of a descrambler.

Claim 40 (original): The apparatus of claim 37 wherein $\omega(b_i)$ is determined in accordance with the following relationship:

$$\omega(b) = \frac{1}{b \cdot 2^b} \sum_{i=1}^{2^b} \sum_{j \neq i}^{\chi_i} \frac{d_H(a_i, a_j)}{\chi_i},$$

b represents a number of bit positions of a quadrature-amplitude-modulation symbol, a_i represents a label for the i^{th} point of a constellation associated with a subchannel, a_j represents a label for the j^{th} point of a constellation associated with a subchannel, and χ_i represents a coordination number of the a_i^{th} point, $d_H(a_i,a_j)$ represents a Hamming distance between respective binary vectors associated with points a_i and a_j.

Claim 41 (original): The apparatus of claim 35 further comprising:

means for determining a total increase in the number of bits to be sent in a DMT symbol ($G_l(t,K,k)$) in accordance with the following relationship:

$$G_d(t,K,k) \equiv B_{DMT}(t,K,k) - B_{DMT}(0,K,1).$$

Claim 42 (currently amended): An apparatus for determining an uncoded bit error rate p_b based on a target symbol error rate ε_s and a maximum number of transmissions k of a frame, comprising:

means for determining the uncoded bit error rate p_b based on a weighted series expansion of the target bit error rate ε_s, comprising weights W that are a function of a maximum number of symbol errors that can be corrected t and a number of symbols in an information field K of the frame; and

means for selecting the maximum number of symbol errors t, the number of symbols in the information field K of the frame and the maximum number of transmissions k of the frame, such that the uncoded bit error rate p_b that produces a symbol error rate that is less than or equal to the target symbol error rate ε_s is largest.

Claim 43 (original): The apparatus of claim 42 wherein said weighted series expansion to determine said uncoded bit error rate p_b comprises the following relationship:

$$p_b = 1 - \left(1 - W\left(t, K, k\right) \varepsilon_S^{\frac{1}{(t+1)k}} \right)^{1/\alpha}$$

wherein

$$W(t,K,k) = \left[\binom{K+C+R-1}{t} \right]^{-\frac{1}{(t+1)k}} \left[\binom{K+C+R}{t+1} \right]^{-\frac{k-1}{(t+1)k}},$$

C+R represents a number of redundant symbols in an error correction field.

Claim 44 (original): An apparatus for selecting transmission parameters a multicarrier system having a channel comprising a plurality of subchannels, comprising:

means for selecting a number (s) of discrete multi-tone symbols in a forward-error-correction frame, a number (z) of forward-error-correction control symbols in a discrete multitone symbol, and a maximum number of transmissions (k), based on a signal-to-noise ratio and a number of subchannels associated with the signal-to-noise ratio; and

means for transmitting information in accordance with the selected number (s) of discrete multi-tone symbols, the number (z) of forward-error-correction control symbols in the discrete multitone symbol and the maximum number of transmissions (k).

Claim 45 (original): The apparatus of claim 44 wherein said means for selecting comprises selecting an adjustment value per subchannel based on the signal-to-noise ratio and the number of subchannels associated with the signal-to-noise ratio; and

means for adjusting a number of bits per subchannel for at least one subchannel in accordance with the adjustment value.

Claim 46 (original): The apparatus of claim 44 wherein the signal-to-noise ratio is an average signal-to-noise ratio of the associated number of subchannels.

Claim 47 (original): The apparatus of claim 44 further comprising:

means for storing, in a table, the number (s) of discrete multi-tone symbols in the forward-error-correction frame, the number (z) of forward-error-correction control symbols in the discrete multitone symbol associated with the signal-to-noise ratio, the maximum number of transmissions (k) and the number of subchannels associated with the signal-to-noise ratio, for different values of s, z, signal-to-noise ratios and numbers of subchannels.

Claim 48 (original): The apparatus of claim 47 wherein for each value of signal-to-noise ratio and number of bits per subchannel of the table, the associated values of s, z and k are also associated with an adjustment value that provides a maximal net coding gain g_n, such that the associated values of s, z and k is selected from a subset of associated s, z and k values.

Claim 49 (original): An apparatus for determining an optimum bit load b per subchannel in a multicarrier system with forward error correction, comprising:

means for computing one or more values of a maximum number of symbol errors that can be corrected t, a number of symbols in the information field K and a maximum number of transmissions k to determine the optimum bit load per subchannel in accordance with the following relationship:

$$b = [\gamma + \Phi(\gamma, t, K, k, \varepsilon)]/10\log 2$$

wherein

$$\Phi(\gamma,t,K,k,\varepsilon)=10\log\left\{10^{-\gamma/10}+\frac{3\log e}{2\log\left[\dfrac{\alpha\langle\omega(b)\rangle\sqrt{8/\pi}}{W(t,K,k)(\alpha\,\varepsilon/\beta)^{\frac{1}{(t+1)k}}}\right]-\log\log\left[\dfrac{\alpha\langle\omega(b)\rangle\sqrt{8/\pi}}{W(t,K,k)(\alpha\,\varepsilon/\beta)^{\frac{1}{(t+1)k}}}\right]+\log\left(\dfrac{\log e}{2}\right)}\right\}$$

$$W(t,K,k)=\left[\binom{K+C+R-1}{t}\right]^{-\frac{1}{(t+1)k}}\left[\binom{K+C+R}{t+1}\right]^{-\frac{k-1}{(t+1)k}},$$

$$\langle\omega(b)\rangle=\frac{1}{\mathrm{b}_{\max}}\int_{1}^{\mathrm{b}_{\max}}\omega(b)\left(1-2^{-b/2}\right)db$$

α represents a number of bits per symbol, γ represents a signal-to-noise ratio, ε represents a target symbol error rate, k represents a maximum number of transmissions, C+R represents a number of redundant symbols in an error correction field, b represents a number of bit positions of a quadrature-amplitude-modulation symbol, $\omega(b)$ represents an average fraction of erroneous bits in an erroneous b-sized quadrature-amplitude-modulation symbol, and b_{max} is a maximum number of bit positions of the quadrature-amplitude-modulation symbol per subchannel; and

means for selecting a bit load per subchannel in accordance with the maximum number of symbol errors that can be corrected t, a number of symbols in the information field K and the maximum number of transmissions k.

Claim 50 (original): A method for transmitting data in a multi-carrier system between a downstream station and an upstream station, coupled by a channel having a plurality of subchannels, comprising:

a transmitter to transmit an information frame from the upstream station;

a receiver to receive the information frame at the downstream station, the receiver to determine whether the information frame is non-correctable, and transmit a negative acknowledgement when the information frame is non-correctable;

wherein the transmitter, in response to the negative acknowledgment, transmits the information frame if the information frame has not be transmitted a predetermined number of times from the upstream station.

Claim 51 (original): The apparatus of claim 50 wherein the predetermined number of times is determined in accordance with a measured signal-to-noise ratio value representing at least a subset of the subchannels of the channel, and forward error correction parameters.

Claim 52 (original): The apparatus of claim 50 wherein the multi-carrier system is a discrete multi-tone system.

Claim 53 (original): The apparatus of claim 50 wherein the discrete multi-tone system comprises the G-lite standard.

Claim 54 (original): The apparatus of claim 50 wherein the discrete multi-tone system comprises the G.dmt standard.

Claim 55 (original): The apparatus of claim 50 wherein the forward error correction parameters are Reed-Solomon forward error correction parameters.